Technical Report 454

DISCRIMINANT FUNCTION JOB ANALYSIS IN THREE ARMY TECHNICAL MOS

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U. S. Army
Research Institute for the Behavioral and Social Sciences

July 1980

U. S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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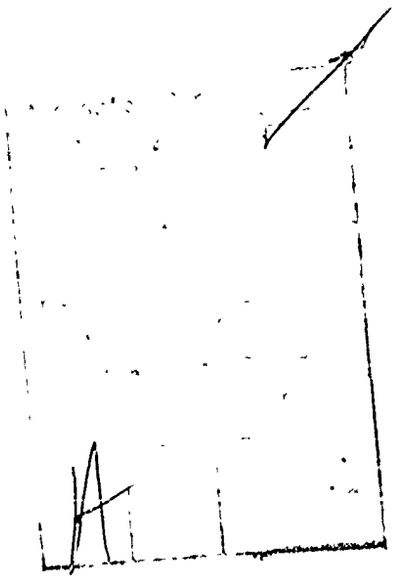

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(14) ARI-TR-454

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

(9) 1. REPORT NUMBER: Technical Report 454

2. GOVT ACCESSION NO.: AD-A097682

3. RECIPIENT'S CATALOG NUMBER:

(6) 4. TITLE *(and Subtitle)*: DISCRIMINANT FUNCTION JOB ANALYSIS IN THREE ARMY TECHNICAL MOS

5. TYPE OF REPORT & PERIOD COVERED:

6. PERFORMING ORG. REPORT NUMBER:

(10) 7. AUTHOR(s): Guy L. Siebold

8. CONTRACT OR GRANT NUMBER(s):

(16)

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
US Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue
Alexandria, VA 22333

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
2Q163743A794

11. CONTROLLING OFFICE NAME AND ADDRESS:
US Army Military Personnel Center
2461 Eisenhower Avenue
Alexandria, VA 22331

(11)

12. REPORT DATE: July 1980

13. NUMBER OF PAGES: 36

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*:
(12) 47

15. SECURITY CLASS. *(of this report)*: Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release, distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Job Analysis	Training Priority
Task Analysis	Aviation Maintenance
Task Criticality	Instructional Systems Development
Training	Discriminant Function Analysis

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This paper presents a technique to facilitate the determination of task training priority in Military Occupational Specialties (MOS). The job data analyzed consisted of scale ratings on tasks performed in three aviation maintenance MOS. Job incumbents rated MOS tasks they performed on a Relative Time Spent Performing scale. Supervisors rated all tasks in their MOS on four scales: Task Learning Difficulty, Consequences of Inadequate Performance, Immediacy of Task Performance, and Type of Training.

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Unclassified 408010

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. (cont'd)

An examination of the criterion Type of Training scale revealed that the data produced were not normally distributed and that the Type of Training scale categories were at the nominal level of measurement. These Type of Training scale characteristics made standard multiple regression analysis less desirable than discriminant function analysis, which is more compatible with these particular characteristics. For the discriminant analysis, the seven response categories for the Type of Training scale were collapsed into two new categories: tasks to be trained at local units and tasks to be trained in a formal school setting.

The results indicated that the discriminant functions could classify tasks in the appropriate training category by incorporating the mean ratings per task on the four predictor scales. The discriminant function categorization agreed about 80% of the time with supervisor classifications based on the raw frequency of training choices. When there was disagreement in task training categorization, the supervisors' priority rating was typically anomalous. In practice, supervisors could be required to justify explicitly why they chose to deviate from the computer-generated discriminant function classification. Besides capturing the underlying task training priority policy of the supervisor raters, the discriminant function technique also automatically draws lines for job analysts between tasks that should be taught in schools and those that should be taught in local units.

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Office, Deputy Chief of Staff for Personnel
Department of the Army

July 1980

Army Project Number
2Q163743A794

Training Models

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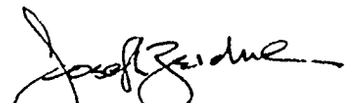
FOREWORD

The Training Technical Area of the US Army Research Institute for the Behavioral and Social Sciences (ARI) has actively pursued a program of research in support of the systems engineering of training. A major focus of this research is to develop the fundamental data and technology necessary to field integrated systems for improving individual job performance.

This report is the third of several on job analysis procedures in the Instructional Systems Development (ISD) model of training. Previous ARI Technical Reports 343 and 432 demonstrated that ISD procedures were applicable to technical and semi-technical MOS. The present paper develops the discriminant function analysis technique to facilitate the determination of task training priority. The technique has a particular advantage in that it provides for an initial computer decision on which tasks should be trained in schools. The research was conducted in response to requirements for the Military Personnel Center (MILPERCEN). MILPERCEN and the US Army Transportation School (USATSCH) were involved in the initial phases of the effort. Data collection occurred with the support of installations in CONUS, Germany, Alaska, Hawaii, and Korea. The research was completed by ARI personnel under Army Project 2Q163743A794, FY 1980.



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DISCRIMINANT FUNCTION JOB ANALYSIS IN THREE ARMY TECHNICAL MOS

BRIEF

Requirement:

To develop a technique to facilitate the determination of task training priority in military occupational specialties (MOS).

Procedure:

Job analysis data from three aviation maintenance MOS were subjected to discriminant function analysis. The data consisted of scale ratings on lists of tasks performed in each MOS. MOS job incumbents rated their applicable tasks on a Relative Time Spent Performing scale. MOS supervisors rated all their MOS tasks on four scales: Task Learning Difficulty, Consequences of Inadequate Performance, Immediacy of Task Performance, and Type of Training. The seven response categories for the Type of Training scale were collapsed into two new categories for the discriminant analysis. The first new category was for tasks to be trained at local units. The second new category was for tasks to be trained in a formal school setting.

Findings:

The discriminant functions effectively classified tasks in the appropriate Type of Training category. About one half of the tasks were classified as requiring training in a formal school setting. The discriminant function categorization agreed with the modal supervisor classification for about eighty percent of the tasks. The Task Learning Difficulty and Consequences of Inadequate Performance scales were the most influential.

Utilization of Findings:

The discriminant function analysis technique appears superior to the traditional multiple regression procedures as a method for determining task training priority. The discriminant function technique is compatible with a nominal level of measurement Type of Training scale and automatically draws lines between tasks that upon initial consideration should be taught in local units and tasks that should be taught in schools.

DISCRIMINANT FUNCTION JOB ANALYSIS IN THREE ARMY TECHNICAL MOS

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DISCRIMINANT FUNCTION JOB ANALYSIS IN THREE ARMY TECHNICAL MOS

INTRODUCTION

The purpose of this paper is to present a technique to facilitate the determination of task training priority in military occupational specialties (MOS). The paper is the outgrowth of research described in detail in a companion report.[1] As in the companion report, the information in this paper is pertinent to personnel and organizations in the Army who are involved in the analysis phase of the Instructional Systems Development (ISD) process.

Job analysts in Army schools receive a substantial amount of survey information on MOS tasks from the Military Personnel Center (MILPERCEN). This information consists of the demographic characteristics of soldiers in the MOS under consideration and the time soldiers spend performing MOS tasks. MILPERCEN (or Army schools) also has the capability of obtaining supervisory ratings on the MOS tasks by using various training priority factor rating scales. Once this information is available, its use in determining training priority for tasks involves a complex process of weighting the various factor scale ratings to rank the tasks for inclusion in school training. The discriminant function technique described in this paper eliminates the need for analysts to use this time-consuming weighting process and lets the computer "draw lines" between those tasks that should be taught in schools and those tasks that should be taught at local units. The computer decision would of course only be an initial determination, but explicit justification could be required for deviations from the initial computer outcomes.

DATA COLLECTION

The job analysis data analyzed in this paper were collected from job incumbents and supervisors in nine aviation maintenance MOS at numerous installations in the continental United States (CONUS), Germany, Korea, Alaska, and Hawaii. A team of researchers personally administered questionnaires to groups of these respondents at their installations. The questionnaires consisted of background items and a list of tasks pertinent to the MOS. Job incumbents were asked to rate tasks on the relative time they spent performing the tasks. Supervisors rated the tasks on four scales: Task Learning Difficulty, Consequences of Inadequate Performance, Immediacy of Task Performance, and Type of Training. These scales and directions for their use are given in Appendix A.

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[1] Siebold, G. L. The applicability of the ISD 4-factor model of job analysis in identifying task training priority in nine technical Military Occupational Specialties. ARI Technical Report 432, October 1979.

TYPE OF TRAINING SCALE

The idea to use the discriminant function technique was generated by the analysis of the Type of Training scale. Typically the job incumbent ratings on the relative time spent scale and the supervisor ratings on the first three scales cited above are used in multiple regression analysis with the Type of Training scale as the dependent variable or criterion. The assumption behind this procedure is that supervisors have an underlying theory or policy in mind when they rate tasks for type of training. By capturing this policy and its component variables, one can obtain a more reliable, understandable, and useful means to determine the preferable type of training for a task.

The multiple regression technique is applicable if the Type of Training scale and other scale responses are normally distributed. A normal distribution for Type of Training is expected because of the assumption that the scale covers a formality of training dimension. Regression analysis is very robust so that a distribution need only approximate normality. As will be shown below, the Type of Training scale does not closely approach normality. Thus while it can be used for multiple regression analysis to obtain task training priority weights, a better approach is to use discriminant function analysis which does not require the criterion Type of Training scale to be normally distributed. Further, the discriminant analysis technique can greatly facilitate implementation of the job analysis procedure to assign task training priority because there is no need to use the complex weighting process.

The response frequency distributions from the Type of Training scale for three MOS are presented in Tables 1, 2, and 3. The responses are broken down by task areas as well as given in total. Task areas are arbitrary groupings of similar tasks. The areas proceed from those in which tasks are predominantly done by lower level job incumbents to those areas in which tasks are predominantely performed by supervisors. Labels for these task areas are given in Appendix B.

The cell figures in the tables are a percentage of ratings that the type of training (row) received in a task area (column). The number of ratings in an area consists of the number of tasks in the area multiplied by the number of supervisors rating the tasks. For example, if there are 100 tasks in a task area and there are 50 supervisor raters, the number of ratings is 5,000.

The response distribution for each task within a task area is generally consistent with the pattern shown for the aggregate of tasks in the area. In all the MOS, the modal response for each task is either "Supervised OJT" or "Residence School Training." The number of supervisor choices in response categories 2, 4, and 6 varies considerably. Response categories 1, 3, 5, and 7 are smaller and more consistent in frequency across the task areas (row figures).

Table 1

MOS 67U - CH-47 HELICOPTER REPAIRMAN

TYPE OF TRAINING RESPONSES	TASK AREAS												
	AREA A (%)	AREA B (%)	AREA C (%)	AREA D (%)	AREA E (%)	AREA F (%)	AREA G (%)	AREA H (%)	AREA I (%)	AREA J (%)	AREA K (%)	TOTAL (%)	SPLIT (%)
1. No Training Required	2.6	1.7	1.1	.4	.7	.7	1.9	1.1	2.3	1.2	2.7	1.8	
2. Supervised OJT	35.0	36.7	28.2	25.3	27.2	31.8	48.6	26.5	27.9	27.2	33.7	31.1	
3. Nonresident School Training (Correspondence Course)	3.2	2.8	2.2	2.5	3.4	3.5	2.9	1.8	3.5	4.3	3.1	3.1	
4. Formal Unit Training	12.0	10.7	8.1	6.4	8.1	8.0	12.2	9.1	18.3	18.8	20.9	12.9	48.9
5. Installation Support School	6.9	6.8	6.2	7.1	6.1	7.4	6.1	7.8	9.4	9.0	8.3	7.6	
6. Residence School Training	37.8	39.0	51.9	57.5	53.0	47.8	26.5	50.7	37.2	38.8	30.8	41.6	
7. Contractor Training	2.4	2.3	2.2	.8	1.5	.7	1.9	3.0	1.5	.8	.6	1.9	51.1
Total Percent (Rounded)	99.9	100.0	99.9	100.0	100.0	99.9	100.1	100.0	100.1	100.1	100.1	100.0	100.0
Number of Ratings (N)	10645	2692	2811	1604	3098	949	1884	5081	9180	2661	1706	42311	42311

Table 2

MOS 68F - AIRCRAFT ELECTRICIAN

TYPE OF TRAINING RESPONSES	TASK AREAS						
	AREA A (%)	AREA B (%)	AREA C (%)	AREA D (%)	AREA E (%)	TOTAL (%)	SPLIT (%)
1. No Training Required	5.1	0.0	1.0	2.2	12.8	4.4	
2. Supervised OJT	42.6	15.9	27.3	53.4	37.6	39.2	
3. Nonresident School Training (Correspondence Course)	1.0	.2	.2	2.7	.3	1.0	
4. Formal Unit Training	1.5	2.5	4.1	14.5	22.3	5.6	50.2
5. Installation Support School	7.0	4.9	14.7	7.7	10.1	8.0	
6. Residence School Training	37.3	73.5	49.5	17.2	15.3	37.6	
7. Contractor Training	5.6	2.9	3.1	2.2	1.6	4.2	49.8
Total Percent (Rounded)	100.1	99.9	99.9	99.9	100.0	100.0	100.0
Number of Ratings (N)	2282	446	483	627	367	4205	4205

Table 3

MOS 68G - AIRFRAME REPAIRMAN

TYPE OF TRAINING RESPONSES	TASK AREAS							
	AREA A (%)	AREA B (%)	AREA C (%)	AREA D (%)	AREA E (%)	AREA F (%)	TOTAL (%)	SPLIT (%)
1. No Training Required	1.8	5.1	.8	4.8	3.5	1.1	2.5	
2. Supervised OJT	34.0	44.2	34.9	11.9	22.1	22.5	30.8	
3. Nonresident School Training (Correspondence Course)	3.5	10.9	8.4	3.3	2.7	3.4	4.7	
4. Formal Unit Training	12.5	16.2	22.0	5.2	9.1	3.4	12.8	50.8
5. Installation Support School	5.9	2.6	11.2	6.9	6.4	6.7	6.6	
6. Residence School Training	39.9	18.1	21.0	60.2	49.7	61.8	39.2	
7. Contractor Training	2.4	3.0	1.8	7.8	6.4	1.1	3.5	49.3
Total Percent (Rounded)	100.0	100.1	100.1	100.1	99.9	100.0	100.1	100.1
Number of Ratings (N)	2718	432	796	581	714	89	5330	5330

The Total column indicates that the Type of Training scale distribution is tri-modal and, hence, not normal. The four predictor scale response distributions, which were double checked because of the irregularity in the Type of Training scale, approximate normal distributions. The four moment statistics were used to make this evaluation of normality. Table 4 presents moment statistics for seven arbitrarily chosen sample tasks in the three MOS for Type of Training. Table 5 presents the same for the sample tasks on the four predictor scales in MOS 68F. The skewness measure (A_3) indicates whether a distribution is symmetrical or "tails off" to one side. An A_3 value of zero means a distribution is symmetrical like the normal distribution; a positive value means it's skewed in the positive direction; a negative value means it's skewed in a negative direction. Table 4 shows the sample task Type of Training distributions are frequently very skewed. Table 5 shows that the predictor scale task distributions for 68F are fairly symmetrical.

The measure of kurtosis (A_4) indicates whether a distribution is more peaked or more flat than a normal distribution which has an A_4 value of zero. A value of less than zero means that the distribution curve is flatter than a normal distribution. Conversely, an A_4 of greater than zero indicates the distribution is more peaked. The figures in Tables 4 and 5 illustrate that the Type of Training response distributions are frequently more peaked or flat than normal distributions while the four predictor scale distributions are quite close to normal.

DISCRIMINANT FUNCTION ANALYSIS

Multiple regression is an applicable technique when the dependent or criterion variable approximates a normal distribution. Discriminant function analysis is appropriate when the criterion variable is composed of two or more nominal (level of measurement) categories. In discriminant analysis, the normally distributed predictor scale values are used to assign cases to the criterion scale categories in which they most likely belong. The configuration of data in the present study indicates that the criterion Type of Training scale should be considered at the nominal level of measurement. Previously in multiple regression analysis, Type of Training was considered an interval level scale representing an underlying dimension of the degree of formal training required for a soldier to learn a task.

Type of Training implies both task training priority and where to train. Every task requires some training. Even "sweep the floor" requires that the person sweeping the floor knows when to sweep it, where the broom and dustpan are located, and what to do with the debris. Because this task is quickly trained anywhere, its rating would indicate no training priority and no special locus for training. On the other hand, tasks which are crucial to a job and difficult to learn typically would be rated high on training priority and in need of a specialized training locus. Discriminant function analysis can take advantage of both the priority and locus aspects of Type of Training.

Table 4

TYPE OF TRAINING MOMENTS BY MOS

		MOS 67U				MOS 68F			
		$\overline{X}$	S	A_3	A_4	$\overline{X}$	S	A_3	A_4
Task	020	3.72	1.78	.25	-1.63	5.35	1.35	-1.81	1.54
Task	040	4.29	1.74	-.31	-1.57	5.37	1.57	-1.82	1.87
Task	060	4.73	1.67	-.74	-1.08	3.10	2.00	.85	-1.07
Task	080	3.63	1.87	.36	-1.58	2.63	1.71	1.25	-.11
Task	100	4.92	1.68	-.95	-.73	5.45	1.50	-1.81	1.45
Task	120	4.50	1.80	-.46	-1.53	5.32	1.57	-1.48	.49
Task	140	4.76	1.69	-.77	-1.10	5.60	1.14	-2.15	3.74

		MOS 68G			
		$\overline{X}$	S	A_3	A_4
Task	020	3.74	1.77	.25	-1.73
Task	040	4.63	1.67	-.63	-1.34
Task	060	3.97	1.98	-.16	-1.75
Task	080	3.08	1.82	.91	-.57
Task	100	3.73	1.63	.27	-1.53
Task	120	5.38	1.36	-1.77	2.44
Task	140	4.57	1.75	-.61	-1.19

$\overline{X}$ = Mean; S = Standard Deviation; A_3 = Skewness; A_4 = Kurtosis

Table 5

MOS 68F - TASK MOMENTS BY PREDICTOR SCALE

		Relative Time Spent Performing				Task Learning Difficulty			
		$\overline{X}$	S	A_3	A_4	$\overline{X}$	S	A_3	A_4
Task	020	2.92	1.47	.69	-.14	3.68	1.43	.66	-.40
Task	040	3.84	2.04	.10	-1.31	4.86	1.70	-.20	-1.31
Task	060	4.05	1.73	-.05	-.91	3.30	1.40	-.15	-.90
Task	080	3.19	1.71	.67	-.36	3.23	1.31	-.17	-.51
Task	100	3.28	1.56	.39	-.13	4.76	1.34	.31	-1.08
Task	120	4.07	1.60	.21	-.87	4.82	1.37	-.23	-.89
Task	140	2.85	1.58	.44	-.82	5.19	1.40	-.01	-1.50

		Consequences of Inadequate Performance				Immediacy of Task Performance			
		$\overline{X}$	S	A_3	A_4	$\overline{X}$	S	A_3	A_4
Task	020	4.23	1.31	.22	-.58	4.18	1.30	-.21	.24
Task	040	4.55	1.65	-.65	-.11	3.83	1.27	-.35	-.34
Task	060	4.48	1.38	-.69	-.07	4.78	1.20	-.05	-.19
Task	080	3.48	1.65	.07	-1.12	4.44	1.53	-.29	-.32
Task	100	4.68	1.21	-.51	-.83	4.41	1.30	-.13	-.57
Task	120	4.91	1.28	-.10	-.38	4.82	1.22	-.13	-.20
Task	140	4.57	1.47	.29	-1.00	4.00	1.07	-.47	-.38

$\overline{X}$ = Mean; S = Standard Deviation; A_3 = Skewness; A_4 = Kurtosis

PROCEDURE

For purposes of analysis, the seven Type of Training categories were collapsed into two categories. The first new category consisted of the old categories in which the locus of training is in the soldiers' unit: (1) no training, (2) supervised on-the-job training, (3) nonresident school training (correspondence course), and (4) formal unit training. The other new category consisted of the old categories in which the locus of training is in a formal school: (5) installation support school, (6) residence school training, and (7) contractor training. The number of supervisor choices were about equally divided between the two new categories for each of the three MOS under consideration (see last "SPLIT" column in Tables 1, 2, and 3).

Discriminant function analysis was performed using the stepwise Rao's V method.[2] The four predictor scale mean values per task were used to develop discriminant and classification functions. Tasks were placed in new category 1 or 2 based on the function predictions. For comparison, supervisor Type of Training choices were used to classify tasks in new category 1 or 2. A task was assigned to new category 1 if fifty percent or more of the ratings were given to old categories 1 through 4. If less than fifty percent of the supervisor choices were given to categories 1 through 4, the task was assigned to new category 2.

RESULTS

As shown by Table 6, classification of tasks by the discriminant function method agreed with the supervisor classifications about eighty percent of the time. Thus decisions using discriminant equations to assign tasks to either unit or school training would be the same as a panel of supervisor experts roughly four out of five times. The discriminant functions captured the rating policies of the supervisors to a substantial degree.

Because of the success obtained with MOS 67U, 68F, and 68G, three more of the original nine MOS were put through discriminant analysis. Table 7 shows the results for these additional MOS. Again similar classification occurred roughly eighty percent of the time. The off-diagonal or disagreement cells are proportionately equal. It appears that misclassifications occur about equally in both directions.

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[2]Reference Klecka, W. R. Discriminant Analysis. In Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., and Bent, D. H., SPSS: Statistical Package for the Social Sciences (2d Ed.). New York: McGraw-Hill, 1975. Computer support for this research was provided by Bettie M. Teevan, ARI.

Table 6

CLASSIFICATION OF TASKS FOR TYPE OF TRAINING BY MOS

A. MOS 67U

Supervisor Choice	Discriminant Equation Choice: Unit Training	School Training	N
Unit Training	119 (80.4%)	29 (19.6%)	148 (100%)
School Training	23 (13.7%)	145 (86.3%)	168 (100%)

Tasks Similarly Classified: 264 (83.5%)

B. MOS 68F

Supervisor Choice	Discriminant Equation Choice: Unit Training	School Training	N
Unit Training	104 (88.1%)	14 (11.9%)	118 (100%)
School Training	8 (8.2%)	90 (91.8%)	98 (100%)

Tasks Similarly Classified: 194 (89.8%)

C. MOS 68G

Supervisor Choice	Discriminant Equation Choice: Unit Training	School Training	N
Unit Training	56 (74.7%)	19 (25.3%)	75 (100%)
School Training	13 (18.1%)	59 (81.9%)	72 (100%)

Tasks Similarly Classified: 115 (78.2%)

Table 7

CLASSIFICATION OF TASKS FOR TYPE OF TRAINING BY ADDITIONAL MOS

A. MOS 67X - CH-54 Helicopter Repairman

	Discriminant Equation Choice		
Supervisor Choice	Unit Training	School Training	N
Unit Training	40 (75.5%)	13 (24.5%)	53 (100%)
School Training	33 (12.7%)	227 (87.3%)	260 (100%)

Tasks Similarly Classified: 267 (85.3%)

B. MOS 68D - Aircraft Powertrain Repairman

	Discriminant Equation Choice		
Supervisor Choice	Unit Training	School Training	N
Unit Training	49 (79.0%)	13 (21.0%)	62 (100%)
School Training	31 (16.6%)	156 (83.4%)	187 (100%)

Tasks Similarly Classified: 205 (82.3%)

C. MOS 68H - Aircraft Hydraulics Repairman

	Discriminant Equation Choice		
Supervisor Choice	Unit Training	School Training	N
Unit Training	63 (78.7%)	17 (21.2%)	80 (100%)
School Training	24 (29.3%)	58 (70.7%)	82 (100%)

Tasks Similarly Classified: 121 (74.7%)

Table 8

STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS BY MOS

Scale	MOS					
	67U	68F	68G	67X	68D	68H
1. Relative Time Spent Performing	.11	-.15	--	--	.10	--
2. Task Learning Difficulty	-.61	-.91	.75	1.09	-.61	.36
3. Consequences of Inadequate Performance	-.29	-.10	.31	-.45	-.57	.81
4. Immediacy of Task Performance	-.26	--	--	.31	--	--

Table 8 presents the standardized discriminant function coefficients for the six MOS. If one disregards their signs, these coefficients indicate the relative weight of each scale in discriminating between unit and school training. As in multiple regression, the second and third scales are consistently the most important. Since the coefficients vary substantially from one MOS to another, the discriminant functions, like the multiple regression equations, appear to be MOS specific. Summary tables containing more detailed discriminant analysis information are given in Appendix C. Three sample tasks are used in Appendix D to illustrate how the discriminant function information is used.

SUMMARY

The purpose of this paper is to present the discriminant function analysis technique as a method to facilitate the determination of task training priority. An examination of the Type of Training scale revealed that the data it produced were not normally distributed. The categories in the Type of Training scale appeared to be at the nominal level of measurement. The multiple regression technique, which has traditionally been used in assessing task training priority, requires that the criterion scale - Type of Training - be at the interval level of measurement and produce normally distributed data. Further, the multiple regression technique involves a complex weighting process to be used by job analysts. The discriminant function analysis technique, which is compatible with a nominal level Type of Training scale, is shown to capture the underlying task priority policy of the supervisor raters. Also the discriminant function technique can automatically draw lines for job analysts between tasks that should be taught in schools and those that should be taught in local units.

The procedure used in this paper was to collapse the seven Type of Training scale categories into two new categories. The first new category was for tasks to be trained at local units. The second new category was for tasks to be trained in a formal school setting. The results indicated that the discriminant functions could classify tasks in the appropriate category through the mean ratings on the four traditional predictor scales. The discriminant function categorization agreed with supervisor raw classification about eighty percent of the time. When there was disagreement in task training categorization, the tasks involved usually had an anomalous value on one of the rating scales. The discriminant equations were MOS specific. The Task Learning Difficulty and Consequences of Inadequate Performance scales were the most influential across MOS.

APPENDIX A

Questionnaire Directions (in part) and Rating Scales

Relative Time Spent Performing (Incumbents Only).

Beginning on the next page is a list of tasks performed by personnel in your duty Military Occupational Specialty (MOS). Tasks performed are grouped under Duty Categories for convenience. Carefully read each task statement in the entire list. No two task statements are exactly the same, although you may find some that seem to be very similar. Circle the task number to the left of the tasks that you perform in your current job. If you perform some tasks on your job that are not included in this inventory, you will have a chance to write them in at the end of the inventory. Do not circle a task number if you do not perform the task in your current job. Fill in the oval to the left of the task number for every task you have circled in your task inventory booklet. Do not mark the ovals to the right of the task numbers at this time.

When you have darkened the oval corresponding to all of the tasks you have circled, please read the following instructions before proceeding.

a. You are to rate the relative amount of time you spend performing each task you have circled. In making your rating of the relative amount of time spent on each task try to consider both how often you perform the task and the amount of time you spend performing the task.

b. Time Spent means the total time you spend on each task you are rating, compared with the time you spend on the other tasks you do. Remember, you are comparing only the tasks you have circled. USE THE FOLLOWING RATING SCALE.

1. Very Much Below Average
2. Below Average
3. Slightly Below Average
4. About Average
5. Slightly Above Average
6. Above Average
7. Very Much Above Average

c. In using this scale, first identify those tasks which require a great deal of your time. These would be rated as either a 6 or 7 in your answer booklet. Next identify those tasks which require little or none of your time. These would be rated either a 1 or a 2. Then identify tasks on which you spend an average amount of time. Rate these a 3, 4, or 5 as appropriate.

d. When making your ratings, try to use the entire range of the 7 point scale and be sure that each circled task is rated in the answer booklet in one of the seven ovals to the right of the task number.

General Directions for Supervisors.

Following the instructions for Part B in the Task Inventory Booklet is a list of tasks performed by personnel in your MOS. The tasks are grouped under major duty categories for your convenience. Each task is numbered and has a corresponding number in the answer booklet. In this part of the Task Inventory, you are asked to compare and rate the relative "Criticality" (importance) of each of the tasks based on your experience in supervising personnel who perform them. In general, critical tasks are tasks which, if not performed adequately, would seriously impair the overall objectives of the job.

You will be rating each of the tasks on four different rating scales using four separate answer booklets. The scales are Task Learning Difficulty, Consequences of Inadequate Performance, Immediacy of Task Performance and Type of Training. Except for the Type of Training scale, all scale ratings go from 1 "extremely low" to 7 "extremely high."

You are asked to rate all of the tasks for Learning Difficulty, then for Consequences, then Immediacy and finally Type of Training by recording your rating in the answer booklet appropriate for each scale.

BE SURE WHEN RATING THE TASKS ON A SCALE THAT YOU ARE USING THE APPROPRIATE ANSWER BOOKLET.

Task Learning Difficulty (Supervisors Only).

Decide the appropriate Task Learning Difficulty rating for the tasks in the inventory by using the following procedure.

a. You are to rate the relative difficulty in learning each of the tasks. In making your ratings try to consider both the time needed to learn to perform each task satisfactorily and whether, in comparison to the other tasks, it requires systematic training. In other words, the learning difficulty of a task may be thought of as the time involved in "picking up" the task on the job without systematic training. Each of the tasks is to be rated using the following scale.

1. Extremely Low Learning Difficulty - the task is extremely easy to "pick-up" without systematic training.

2. Low.

3. Somewhat Below Average.

4. Average.

5. Somewhat Above Average.

6. High.

7. Extremely High - the task is extremely difficult to learn without systematic training.

b. In using this scale, first identify those tasks which would require a great deal of on-the-job training (OJT) time before someone could perform them satisfactorily. These would be rated either a 6 or a 7 in your answer booklet. Next identify those tasks which could be easily and quickly learned without systematic training on the job. These would be rated either a 1 or a 2. Then identify tasks which would not require a great deal of OJT but could not be performed satisfactorily without some systematic training. Rate these a 3, 4, or 5 as appropriate.

Consequences of Inadequate Performance (Supervisors Only).

Decide the appropriate Consequences of Inadequate Performance rating for each task in the inventory by using the following procedure.

a. In making your rating estimate the probable seriousness of the consequences to your mission resulting from inadequate task performance. For some tasks, the consequences will be negligible. For others, inadequate performance may result in wasted supplies or manhours. For still other tasks, death or damage to important equipment may result. Rate each task using the following scale.

1. Extremely Low - if the task is performed inadequately, the consequences will be negligible.

2. Low.

3. Somewhat Below Average.

4. Average.

5. Somewhat Above Average.

6. High.

7. Extremely High - inadequate performance may result in heavy damage to important equipment, injury or death.

b. In using this scale, first identify those tasks where the probable consequences of inadequate performance would result in death, serious injury or major damage to important equipment. These tasks would be rated a 6 or a 7. Next identify those tasks where the probable consequences of inadequate performance are extremely low or nonexistent. These would be rated either a 1 or a 2. Finally, rate the remaining tasks in terms of wasted supplies, damage to equipment or manhour losses. Rate these tasks a 3, 4, or 5 as appropriate.

c. When making your ratings, try to use the entire range of the 7 point scale and be sure that you rate all of the tasks in one of the seven ovals to the right of the task number.

d. Always be sure that your answer booklet task number corresponds to the same task number in the task inventory booklet.

Immediacy of Task Performance (Supervisors Only).

Decide on the immediacy of task performance rating for each task in the inventory by using the following procedure.

a. In rating each task on the immediacy scale, try to estimate how quickly a task must be performed after the need for its performance becomes known. In other words, think of the delay that could be allowed from the time the soldier becomes aware that he must perform the task and the time he must actually start doing it. Each task is to be rated using the following scale.

1. Extremely Low Immediacy - task performance can be put off indefinitely: is almost never urgent.

2. Low.

3. Somewhat Below Average.

4. Average.

5. Somewhat Above Average.

6. High.

7. Extremely High - task performance must begin instantly.

b. In using this scale, first identify those tasks where no performance delay can be tolerated - the soldier must be capable of doing the task immediately without first getting advice or reading about it.

These tasks would be rated a 6 or a 7. Next identify those tasks where task performance can be put off indefinitely - performance is required but it is never urgent. These would be rated either a 1 or 2. Then identify tasks where other personnel, technical directives, regulations, etc. can be consulted before the task is performed. These would be rated a 3, 4, or 5 as appropriate.

Type of Training (Supervisors Only).

Consider which type of training is best for teaching each task in the booklet. Select one of the types of training listed below and fill in the corresponding oval in the answer booklet.

1. No training required.

2. Supervised OJT.

3. Nonresident School Training (Correspondence Course).

4. Formal Unit Training.

5. Installation Support School.

6. Residence School Training.

7. Contractor Training.

Now start rating the tasks for the type of training required. When you have finished this section, bring your booklets to the survey administrators. They will interview you in order to determine how the questionnaire and the administration procedures can be improved.

APPENDIX B

MOS Task Areas

MOS 67U - CH-47 Helicopter Repairman

A. Perform Flightline Maintenance Duties.

B. Perform Airframe and Fuselage Assemblies Maintenance Duties.

C. Perform Power Plant and Related Systems Maintenance Duties.

D. Perform Rotor/Transmission/Propeller Systems Maintenance Duties.

E. Perform Flight Control Systems Maintenance Duties.

F. Perform Utility Hydraulic Systems Maintenance Duties.

G. Perform General Aircraft Maintenance Duties.

H. Perform Special and Technical Inspections Duties.

I. Perform Maintenance Supervisory and Management Duties.

J. Perform Maintenance Administrative Duties.

K. Perform Maintenance Safety and Fire Prevention Duties.

MOS 68F - Aircraft Electrician

A. Perform Electrical/Electronic/Instrument Repairman Maintenance Duties.

B. Perform Electrical/Electronic/Instrument Components and Systems Testing Duties.

C. Perform Duties of an Aircraft Electrical/Electronic/Instrument Technical Inspection Duties.

D. Perform Shop Operation and Supply Duties.

E. Perform Shop Operations and Supervisory Duties.

MOS 68G - Airframe Repairman

A. Perform Aircraft Structural Repairman Duties.

B. Perform Structural Repair Shop Operation Duties.

C. Perform Shop Supervisory Duties.

D. Perform Airframe Welder Duties.

E. Perform Aircraft Structural Inspector Duties.

F. Perform Nondestructive Testing Duties.

APPENDIX C

Discriminant Analysis Summary Tables

In the following discriminant analysis summary tables, the four predictor scales are coded as follows:

FAC1 = Relative Time Spent Performing

FAC2 = Task Learning Difficulty

FAC3 = Consequences of Inadequate Performance

FAC4 = Immediacy of Task Performance

SUMMARY TABLE: MOS67U - DISCRIMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change in RAO's V	Sig. of Change
1	FAC2	197.96	.61	.00	197.94	197.94	.00
2	FAC3	40.62	.54	.00	264.39	66.44	.00
3	FAC4	1.98	.53	.00	267.97	3.57	.05
4	FAC1	2.66	.53	.00	272.95	4.97	.02

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC1	3.45	2.95
FAC2	11.02	13.12
FAC3	-38.39	-37.38
FAC4	96.30	97.98
CONSTANT	-151.53	-171.69

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC1	.19
FAC2	-.82
FAC3	-.39
FAC4	-.65
CONSTANT	7.97

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	.72
Group 2	-.63

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	.86	.68	.53	195.18	4	.00

SUMMARY TABLE: MOS68F - DISCRIMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change in RAO's V	Sig. of Change
1	FAC2	339.88	.38	.00	339.87	339.87	.00
2	FAC1	10.75	.36	.00	367.84	27.96	.00
3	FAC3	2.50	.36	.00	374.70	6.86	.00

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC1	9.08	10.15
FAC2	14.40	19.66
FAC3	9.21	9.96
CONSTANT	-58.36	-86.89

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC1	-.24
FAC2	-1.20
FAC3	-.17
CONSTANT	6.44

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	.72
Group 2	-.87

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	1.75	.79	.36	215.04	3	.00

SUMMARY TABLE: MOS68G - DISCRMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change in RAO's V	Sig. of Change
1	FAC2	132.86	.52	.00	132.86	132.86	.00
2	FAC3	6.98	.49	.00	146.33	13.46	.00

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC2	5.85	8.13
FAC3	5.37	6.37
CONSTANT	-22.85	-38.08

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC2	.80
FAC3	.35
CONSTANT	-5.38

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	-.69
Group 2	.72

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	1.00	.70	.49	100.47	2	.00

SUMMARY TABLE: MOS67X - DISCRIMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change to RAO's V	Sig. of Change
1	FAC2	162.97	.65	.00	162.96	162.96	.00
2	FAC3	3.79	.64	.00	168.75	5.79	.01
3	FAC4	4.26	.63	.00	175.36	6.60	.01

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC2	4.69	8.54
FAC3	-13.44	-15.28
FAC4	39.95	41.71
CONSTANT	-71.72	-87.07

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC2	1.54
FAC3	-.73
FAC4	.70
CONSTANT	-6.68

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	-1.32
Group 2	.27

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	.56	.60	.63	138.40	3	.00

SUMMARY TABLE: MOS68D - DISCRIMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change in RAO's V	Sig. of Change
1	FAC2	81.88	.75	.00	81.88	81.88	.00
2	FAC3	29.34	.67	.00	121.11	39.23	.00
3	FAC1	1.04	.66	.00	122.69	1.57	.20

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC1	3.59	3.36
FAC2	6.37	8.00
FAC3	9.74	11.30
CONSTANT	-44.30	-59.46

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC1	.11
FAC2	-.81
FAC3	-.79
CONSTANT	7.97

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	.99
Group 2	-.33

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	.49	.57	.66	99.01	3	.00

SUMMARY TABLE: MOS68H - DISCRIMINANT ANALYSIS - RAO METHOD

Step Number	Variable Entered	F to Enter	Wilks Lambda	Sig.	RAO's V	Change in RAO's V	Sig. of Change
1	FAC3	60.60	.72	.00	60.59	60.59	.00
2	FAC2	8.27	.68	.00	72.07	11.47	.00

CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1	Group 2
FAC2	4.38	5.15
FAC3	28.34	31.22
CONSTANT	-71.36	-88.00

UNSTANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

FAC2	.47
FAC3	1.80
CONSTANT	-10.39

CENTROIDS OF GROUPS IN REDUCED SPACE

	Function 1
Group 1	-.56
Group 2	.54

DISCRIMINANT FUNCTION	Eigenvalue	CANONICAL CORRELATION	Wilks Lambda	Chi-Square	DF	Significance
1	.45	.55	.68	59.13	2	.00

APPENDIX D

Use of Discriminant Equations

The use of discriminant equations is basically a mechanical process easily learned by those unsophisticated in statistical procedures. In fact, the results of the equations would best be generated by a computer so that training analysts can spend their time on more crucial matters. Three examples are given here to illustrate and lend meaning to the summary tables presented in Appendix C.

Example A. MOS 68F, Task 020, "Troubleshoot Tachometer Indicating System." The majority of supervisors classified this task as one requiring school training, i.e., category 2. The mean scale scores for the task can be obtained from Tables 4 and 5. They are as follows:

Relative Time Spent Performing	2.92	(FAC1)
Task Learning Difficulty	3.68	(FAC2)
Consequences of Inadequate Performance	4.23	(FAC3)
Immediacy of Task Performance	4.18	(FAC4)
Type of Training	5.35	(FAC5)

The high mean score on Type of Training is consistent with the supervisor classification of the task as one needing school training.

The discriminant equation coefficients can be obtained from Appendix C for MOS 68F. Both the classification and unstandardized discriminant function coefficients are given along with group centroids. The equations are developed by multiplying the coefficients by the related scale means. The classification functions flesh out as follows:

1. Group 1 - Unit Training

   9.08 (2.92) + 14.40 (3.68) + 9.21 (4.23) - 58.36 = 60.10.

2. Group 2 - School Training

   10.15 (2.92) + 19.66 (3.68) + 9.96 (4.23) - 86.89 = 57.23.

Note that only the first three scales were useful in distinguishing between the two training groups. Since the function sum total of Group 1 (60.10) is larger than that of Group 2 (57.23), the functions would classify task 020 as one requiring unit training. Task 020 then is a case where the supervisors and the discriminant equations would classify the task differently. The reason for this disagreement is the mean scale rating for Task Learning Difficulty (3.68) which is low compared to the high Type of Training mean (5.35). Task Learning Difficulty is of course the key discriminating scale for MOS 68F. The disagreement in classification should lead one to question supervisors about why this particular task should receive school training when it is not especially difficult to learn. The discriminant function classification can act as a standard against which supervisors can be required to justify any disagreements for given tasks.

The classification by the functions is confirmed by the unstandardized discriminant function. Using the coefficients from Appendix C in MOS 68F, the equation becomes the following:

6.44 - .24 (2.92) - 1.20 (3.68) - .17 (4.23) = .60.

This resulting figure (.60) is quite close to the centroid for Group 1 (.72) and quite far from the centroid for Group 2 (-.87).

Example B. MOS 68F, Task 040, "Repair Starters." The majority of supervisors classified task 040 as one needing school training. The pertinent first three scale means are 3.84 (FAC1), 4.86 (FAC2), and 4.55 (FAC3). The classification functions flesh out as:

1. Group 1 - Unit Training

   9.08 (3.84) + 14.40 (4.86) + 9.21 (4.55) - 58.36 = 88.40.

2. Group 2 - School Training

   10.15 (3.84) + 19.66 (4.86) + 9.96 (4.55) - 86.89 = 92.96.

Since the function sum total of Group 2 (92.96) is larger than that of Group 1, the functions would classify task 040 as one requiring school training. Thus the supervisors and functions are in agreement for this task. The unstandardized discriminant function confirms this agreement:

6.44 - .24 (3.84) - 1.20 (4.86) - .17 (4.55) = -1.08.

The sum total is close to the centroid of Group 2 (-.87).

Example C. MOS 68F, Task 060, "Install Circuit Controlling Devices (Switches/Relays)." The majority of supervisors classified task 060 as one for unit training. The first three scale means are 4.05 (FAC1), 3.30 (FAC2), and 4.48 (FAC3). The classification functions become filled out as:

1. Group 1 - Unit Training

   9.08 (4.05) + 14.40 (3.30) + 9.21 (4.48) - 58.36 = 67.19.

2. Group 2 - School Training

   10.15 (4.05) + 19.66 (3.30) + 9.96 (4.48) - 86.89 = 63.72.

Since the function sum total of Group 1 is larger than that of Group 2, the functions would classify task 060 as one for unit training. As in the previous task 040, the classification functions and supervisors are in agreement. The unstandardized discriminant function confirms the training choice.

6.44 - .24 (4.05) - 1.20 (3.30) - .17 (4.48) = .75.

This unstandardized discriminant function result is very close to the Group 1 centroid (.72).

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